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VARIATION IN SPORES OF CORN SMUT.

BY A. S. HITCHCOCK, MANHATTAN, KAS.

A DIAGNOSTIC character among cryptogamic plants is the size of the spores. Since the size varies it has been customary in descriptive works to give the spore measurements between the limits of observed variation. These limits show the actual variation, or nearly so, only when a large number of observations are made. It is well known that in many cases of original descriptions the measurements are founded upon too small a number of spores. But suppose the limit of variation is known, it is still desirable to know the usual size. There are only a few individuals that approach either extreme, and the greater number will lie near the average.

A curve might be constructed to show the variation of a given species by laying off abscissas representing equal differences in a given dimension and erecting ordinates whose lengths shall represent the number of spores having the corresponding dimension. If this curve descends rapidly from the maximum and afterwards gradually approaches the axis, it becomes more necessary to know the usual limits than the extremes, since spores lying near the extremes are proportionately more infrequent than where the curve approaches the axis of X more abruptly. The curve will probably always show two points of inflexion, and these two points will represent the usual limits.

In testing the matter by applying it to the measurement of corn smut spores I arrived at a somewhat unexpected result. Spores from several different sources were thoroughly mixed and samples from various parts of the mixture mounted in water. In taking the measurements, all the spores passing within convenient range of the micrometer were measured until about fifty observations were made. The results are in divisions of the eye-piece micrometer, each of which represents 3.85 μ. The 500 spores measured may be arranged as follows:

Diameter....	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1
Number.....	3	2	18	67	92	89	66	41	38	28	21	20	10	4	1

Since it is rather difficult to estimate correctly 1/10 of a division on the micrometer, it will be well to unite the results in pairs. We shall then have:

Divisions	1.7	1.9	2.1	2 3	2.5	2.7	2.9	3.1
Number	5	85	181	107	66	41	14	1

If the curve is constructed for this set of measurements, we find that it is not symmetrical around the axis of Y. It is much steeper on one side than the other. The arithmetical mean does not represent the average diameter. The result shows that the curve is not that of the curve of probability which follows the law of variation in the physical world, but, in this particular case, follows the law governing biological variation. This difference between the laws of variation in the physical and living worlds has been nicely shown by Dr. C. S. Minot.[1] He shows that biological curves rise rapidly to their maximum and then fall on the other side much more gradually.

It will also be seen that over 50 per cent of the spores fall between 2.0 and 2.2, and that nearly 80 per cent fall between 2.0 and 2.5 inclusive.

A similar series of observations was made upon 300 pollen grains of *Acuida tuberculata*, but owing to the uneven surface there was more difficulty in making accurate measurements.

Divisions	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Number	4	10	47	67	96	5.5	9	5	3	3	1

The observer should be careful to measure all the spores in a given field, otherwise there is a tendency to pick out the very large and the very small ones, thus giving these too great a representation.

ON THE MEASUREMENT OF HALLUCINATIONS.

BY E. W. SCRIPTURE AND C. E. SEASHORE, NEW HAVEN, CONN.

IN an article on "Tests on School Children," by E. W. Scripture, in the *Educational Review*, 1893, V. 61, a test on suggestion was proposed, in which a wire was sometimes heated at a given signal and sometimes not. The observer, not knowing the facts of the case, was required to tell when the wire felt hot. When the wire was not heated, but the observer believed it to be heated, the time required for the hallucination to arise was measured.

This crude idea has been taken up on a larger scale this year, and measurements have been made on several persons in several ways. The work so far has been considered to be the preliminary or qualitative stage of the investigation. Before proceeding to the careful and laborious technical work necessary for exact measurements, which must necessarily take a great deal of time, we wish to secure priority rights as the first to measure hallucinations. In the first place, as the suggestion calling out the hallucination is a sensation or a compound of sensations, we can measure the intensity of the stimulus in the usual ways. In the second place, by finding that stimulus whose sensation is not perceptibly different from the hallucination, we measure the intensity of the hallucination. In the third place, by reacting to the hallucination we record the time required for it to appear; in more accurate work the reaction-time is to be subtracted from the total time, but as the hallucination-time in the cases already investigated ranges from seven to thirty seconds it was of no account. Our work has hitherto been confined to the weak hallucinations of sane people. We find very great differences, corresponding to classes of society and to training in scientific judgment. With abnormal persons we shall expect much shorter hallucination-time and much greater intensity.

[1] Proc. A. A. A. S., XXXIX., p. 271.